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ROCKS and MINERALS

A Magazine for Mineralogists, Geologists and Collectors

42

Official Journal of the Rocks and Minerals Association

September, 1941

Vol. 16, No. 9 **25c** Whole No. 122

THE ROCKS AND MINERALS ASSOCIATION

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Organized in 1928 for the increase and dissemination of mineralogic knowledge

To stimulate public interest in geology and mineralogy and to endeavor to have courses in these subjects introduced in the curricula of the public school systems; to revive a general interest in minerals and mineral collecting; to instruct beginners as to how a collection can be made and cared for; to keep an accurate and permanent record of all mineral localities and minerals found there and to print same for distribution; to encourage the search for new minerals that have not yet been discovered; and to endeavor to secure the practical conservation of mineral localities and unusual rock formations.

Ever since its foundation in 1928, the Rocks and Minerals Association has done much to promote the interest in mineralogy. It has sponsored outings, expeditions, formations of mineralogical clubs and the printing of many articles that have been a distinct contribution to mineralogy.

Those of our readers who are members of the Association can rightly feel that they too were sponsors of these many achievements that have helped to give mineralogy a national recognition. Among your friends there must be many who would like to have a part in the Association's work—to share with you the personal satisfaction, the pleasure, and the benefits of membership. Will you give your friends this opportunity to join the Association by nominating them for membership?

Each new member helps to extend the Association's activities—helps to make your magazine larger, better, and more interesting, and above all assists in the dissemination of mineralogical knowledge.

Some advantages of memberships: All members in good standing receive:

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Mineralogical clubs which subscribe for **Rocks and Minerals** also become affiliated members of the Rocks and Mineral Association and enjoy all the advantages which such an affiliation affords.

A number of clubs hold membership in the Association, participate in the annual outings, and co-operate in many ways in furthering the aims and ambitions of the Association.

Affiliation with the world's largest mineralogical society cannot fail to increase membership, enlarge circles of acquaintanceship, and stimulate a keener interest in mineralogy.

A list of affiliated clubs will be found among the back pages of the magazine.

Rocks and Minerals

PUBLISHED MONTHLY

Edited and Published by PETER ZODAC

September 1941

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ROCKS and MINERALS PEEKSKILL, N. Y., U. S. A.

The Official Journal of the Rocks and Minerals Association

Chips From The Quarry

ADDRESSES—NEW AND OLD

During the past five years about 100 members have failed to receive their full quota of 12 issues of ROCKS AND MINERALS for one year and through no fault of ours. This was due to their failure to send us their new addresses after moving to another city.

Most members, after they move, send us their new addresses. Some never do this directly but we obtain them from their old post offices with whom they have left a forwarding address.

When a member moves without leaving a forwarding address nor notifying us of the change, his magazine is returned to us by his old post office, marked "Moved, left no address." His card is then taken out of our mailing file and no more copies are sent him until we obtain his new address. His copies, however, are held for him. In one instance, 8 years passed by before we heard from a member who had moved; the arrival of the copies due her (it was a woman) must have been a most pleasant surprise.

If any of our present members should move, send us your new address giving the old, also. If you forget to do this your magazine may be stopped. If one, two or more years should pass by before you are permanently settled, write us, sending in your old address, and all copies due you will be sent. If you should know a member who has moved and thus failed to receive his full quota of the magazine, urge him to write us about the matter.

We have a few members who are constantly on the move and thus have no permanent address. Their copies are held up until they may be stationed a week or ten days in a locality which is sufficient time for the magazines to reach them.

If at any time a member should receive a defective copy (pages missing or smeared—printers sometimes make mistakes), drop us a card requesting a new copy. Every member in good standing is entitled to 12 perfect copies per year.

Should a member fail to receive his copies regularly, assuming he has not changed his address, the fault may be with the post office. When this happens, members should write us stating what issues failed to arrive and new copies will be sent them.

Peter Zodac

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Vol. 16, No. 9

The Official Journal of the ROCKS and MINERALS ASSOCIATION

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MINERAL FLUORESCENCE WITH MERCURY SPOTLIGHTS

By JULIAN S. HATCHER

After experimenting with mineral fluorescence for a good many years, I have recently gotten hold of a piece of apparatus which has increased the beauty of my collection many fold and has showed me fluorescent effects that I have never been able to obtain before.

Sources of ultraviolet previously used included the Cooper Hewitt Nico mercury vapor lamp, an extremely powerful Hanovia Alpine Sun Hot Quartz mercury arc with Corning Heat resisting "red purple ultra filter #587; a battery of argon bulbs, used both with and without filters; and the purple X bulbs made by General Electric Co., all of which give brilliant effects with such minerals as fluorite, wernerite-scapolite, hyalite, semi-opal and others which are best affected by the long wave or near ultraviolet between 3000 and 4000 Angstroms.

Besides those already mentioned, I have lamps giving off middle ultraviolet in the region of 2537 Angstrom units, which causes the brilliant red fluorescence of the Franklin calcites, the blue of the scheelite and hydrozincite, the green of the Sweetwater agates, the blue of benitoite, and many other effects not obtained with the longer wave lengths. For this purpose I have been using GE germicidal lamps and the R & M cold quartz lamp, both fitted with filters of Red Purple Corex A #986.

With the apparatus mentioned above I had supposed that every desirable fluorescence effect could be obtained and that there would be little need for any additional ultraviolet generators for use in connection with my collection of fluorescent minerals. I never knew how mistaken I was until I got hold of a Conti-Glo high powered ultraviolet spotlight made for theatrical use. What it did to my minerals was a revelation.

It all started with an inquiry directed to the General Electric Company as to whether their mercury vapor spotlight C-H4 or flood light E-H4 would be useful for exciting fluorescence provided they were fitted with filters.

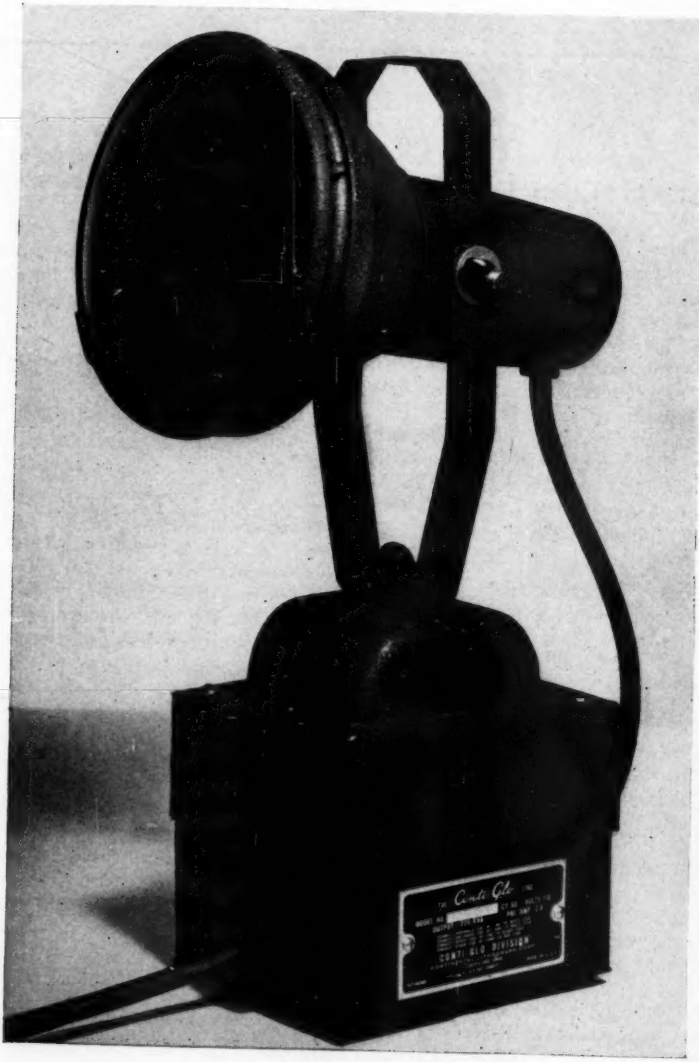
The company replied that while intended for general illumination, these lamps were both potent sources of ultraviolet fluorescent effects; that for such use a filter would be necessary which would be very expensive if made up specially, but reasonable if made in large quantities.

I was further informed that the Continental Lithograph Company of Cleveland, Ohio, had arranged to have such filters made up in quantity by the Corning Glass Works for use in ultraviolet spotlights, and that either the filter or the complete spotlight units could be obtained from the Continental Lithograph Co.

I wrote to this latter firm and they sent a folder describing complete portable high power ultraviolet spotlight and flood light units, for theatrical and advertising display work, which they marketed under the name of Conti-Glo at $31.75.

These outfits are identical except for the bulbs used; the spotlight uses the GE C-H4 bulb, the flood light uses the E-H4 bulb instead.

At this point we might describe these bulbs. Shaped as shown in the sketch, they are mercury lamps in parabolic aluminized reflector bulbs, in which the



The Conti-Glo Ultraviolet Spotlight

metal coated surface of the glass itself acts as the reflector, thus preventing any deterioration of the reflecting surface. The bulb is rated at 100 watts, has a life of 1000 hours, approximately, and costs $12.00. It operates on 110-115 V 60 cycle alternating current only, and requires a transformer, GE 59 G 18, which costs $7.00.

Information included in the Conti-Glo folder included the following:

"When directed upon a fluorescent surface in darkness, the model 93 spot produces a "hot spot" having three to four times the fluorescent brightness noted with a model 91 flood similarly placed. The "spots" are generally recommended in preference to the "floods" when the throw must exceed 20 to 25 feet. Model 93 Spots are being installed in considerable numbers at distances up to 50 feet, and even 75 feet when necessary, in theatre auditoriums and the like for low brightness decorative illumination.

Filter. A convex roundel of heat-resisting ultraviolet filter glass *dark,* transmits harmless long-wave ultraviolet radiations (black light) and absorbs about 97% of the visible radiations, passing only a small amount of visible purple light; held on to front of lamp (with air space between) by a specially designed filter holder, without danger of lamp or filter breakage and without light leakage. (A *light* filter passing higher percentage of both visible and invisible radiations will be substituted on request.)"

As soon as I read this circular I sent in my check for $31.75 and requested shipment of a "spot" light and *both* filters, one to be returned after trial.

These spotlights, in common with all GE H4 type bulbs, require a warm-up period of three minutes to reach full brillance, and if turned off or disconnected, will not start again until they have cooled.

As soon as the spotlight reached full intensity, I turned it on my colllection and saw a sight far, far more magnificent than anything similar that I had ever seen before. This was because the brillance of the fluorescent response was many times greater than I had obtained with any other light; and moreover the very dark filter cut out so much of the visible light that the effect seemed to be intensified; and with the minerals lying on black velvet, the result was spectacular in the extreme. I then tried the filter described as "light," which was said to pass a higher percentage of both visible and ultraviolet. There was no noticeable increase in brightness of the minerals, but everything else was so much more visible that the net result was a considerable loss in the beauty of the display. Needless to say, the "light" filter went back to the maker the next day.

It was evident that the brightness of the minerals under this new unit was much greater than under the Nico, which I had previously found best for lighting large mineral displays. The question was, how much greater?

In order to obtain something based on more than mere human judgment, it was decided to try measuring the brightness of individual large specimens first under the Nico light, then under the Conti-Glo, keeping the specimen at the same distance from each light and using a Weston photronic cell exposure meter for taking the measurements. Specimens tested in this way were wernerite-scapolite, fluorite from Cumberland, England,

C-H4 and E-H4 bulbs

and Corning "fluorescent canary" glass.

The readings obtained were definite, and fairly consistent with all specimens, and showed that each specimen affected the meter from 10 to 20 times as much under the Conti-Glo as under the Nico.

It seems likely that this very great increase in the intensity of the radiations emitted by this lamp may account for the fact that many effects were observed with this apparatus which had not previously been encountered with other lamps.

For example, a specimen of Dolomite crystals on Serpentine from Delta, Harford County, Maryland, which was entirely negative under all other lamps, showed a bright rose fluorescence, and "flashed" with a brilliant red phosphorescence when drawn across the front of the light, just as the Franklin calcites do with the cold quartz light.

Some other interesting results observed with this lamp are noted below:

Gypsum ash tray from Italy. Veins and flaws in the material fluoresced a brilliant red like flames. Very spectacular, looks like flame agate. Negative under all other lights.

Ruby Corundum on margarite from Habersham Co., Georgia. Brilliant deep crimson. Very spectacular; the deepest and most brilliant red fluorescence yet seen. Pale red under Nico and other long wave lights.

Massive Spodumene. Strickland's Quarry, Portland, Conn. Fluoresces pale violet. Phosphoresces strong apricot. Negative under other lights.

Bladed Celestite. Clay Center, Ohio (large number of specimens). Little or no fluorescence, but phosphoresces strong white.

Barite—crystals from Bad Lands of South Dakota; also ball of barite crystals, locality unknown. Fluoresce pale yellow. Phosphoresce strong green.

Precious Opal—Australia—(large number of specimens) Fluoresce strong milk white. Phosphoresce brilliant green, persisting 20 to 25 seconds.

Precious Opals from Nevada, fluoresce cream, no phosphorescence.

Opalized Wood from Bad Lands of South Dakota—Fluoresces bright rusty orange. Negative under other lights.

Agate. Petrified wood from Adamana, Arizona (several samples). Portions fluoresce bright greenish yellow.

Agate. Thunder eggs from Donnybrook, Oregon. Strong milk color.

Thunder eggs from Priday's Ranch, Oregon—the light or milky portions of the core fluoresce a blue-white (these portions may be opal). Light chalky earth adhering to outside of brown matrix fluoresces cream or yellow and phosphoresces a bright yellow green. This appears to be calcite, and acts like the stalactitic or travertine calcite described below.

Calcite. Septerian Nodule from Utah, having a cavity lined with calcite crystals and a matrix veined with travertine. Crystals and veins fluoresce bright yellow green and phosphoresce brilliant yellow green. Fluorescence very weak under Nico and R & M but brilliant under Conti-Glo.

Calcite. Stalactite or travertine calcite. Samples from (1) cavern at Front Royal, Virginia, (2) cavern at Luray, Virginia, (3) near Needles, Calif. Fluoresce pale yellow or cream and phosphoresces bright greenish yellow.

Calcite, Iceland Spar. Out of four (4) samples of optical quality, three were negative and one glowed pink like a live coal. This one also phosphoresced with a bright red flash.

Calcite from Ruby mine, Arizona. Fluoresces bright pink, phosphoresces with a bright red flash. This material fluoresces bright red under cold quartz but is negative under Nico.

Calcite from Franklin, N. J. Many samples were on hand all of which, under the cold quartz light, show reds of varying degrees of brilliance and strength, and all of which phosphoresce with a red flash, and all of which are negative under the Nico and other long wave lights.

With some of these samples the Conti-Glo gives results equal to the cold quartz; with other samples it is entirely negative.

Thus, it can be seen that many substances which are negative or weak under the other lamps are strongly affected by

(*Continued on page 326*)

AGATES OF THE YELLOWSTONE RIVER VALLEY, MONTANA

By THOMAS A. REINER

The moss agates of the Yellowstone Valley in Montana are famous of their beauty and are probably known to every collector and amateur cutter. Fortunate is he who has been accorded the privilege and pleasure of hunting the streams and hills for these agates. The tourist, who goes dashing through the state at 60 miles per hour, pays scant attention to the hunting ground that thousands of collectors would like to spend days prowling over, hunting for that elusive scenic agate that he dreams of. Likewise the geologist has scant time for agate; little thought does he give to rocks unless there are indications of oil, the black gold. Perhaps this is the reason that the geologist who travels the state makes reports on water, oil domes, etc., but when it comes to agates he simply states that they have come from the Rocky Mountains to the west. This is evidently final for him and he never gives it a second thought. However, the source of the Yellowstone agates is not so easily explained and it is the purpose of the writer to try and solve, by elimination and geologic explanation, that the moss agates did not come from the Rocky Mountains to the west as has been explained so casually. He further insists that more sober thought must be given to the subject.

The Yellowstone River, which flows through the valley that is famous for these agates, has its source in the Yellowstone Park (Yellowstone Lake) in northwestern Wyoming. The river flows north through the park to Yellowstone Falls, to the junction with the Lamar River, thence northwest leaving the park near Gardiner, Mont., 50 miles south of Livingston. For the next 25 miles it is a white water stream flowing over huge boulders and falling in elevation at a rapid rate. Midway between Gardiner and Livingston there is a large stream coming in from the east and it is here that a great amount of boulders and gravel has been deposited and it is here that the first hunt for agates may be made.

However, the hunter will be disappointed. No agates will be found. The rocks, however, are characteristic of those found lower, below Billings, on the Yellowstone. These rocks are all smooth, water worn, with no corners, or edges of any kind, and are very hard, containing silica to a large percentage. This is the same story at Livingston, no agates except an occasional clear one, but never a one with moss. Here are your Rocky Mountains, plenty of them on all sides, and if the Yellowstone moss agates had come from this vicinity there should certainly be a trace of them here. From Livingston, the Yellowstone River flows east and will drop 1,000 feet to Billings, 117 miles away down stream to the east. A few miles below Livingston, coming in from the north, is the Shields River which drains the west side of the Crazy Mountains which are over 10,000 feet in altitude but where the Shields River joins the Yellowstone there is no indication of any agates whatever, not even fair sized gravel.

In the Boulder River below Big Timber, about 35 miles northeast of Livingston, boulders are plentiful and of all sizes and shapes but no agate. The Boulder River is a white water stream coming in from the highest mountains of the Bear Tooth. The writer has fished this stream for 20 miles above the junction of the Yellowstone. There were plenty of fish but no agates.

At Columbus on the Stillwater River, another white water stream coming in from the highest mountains to the south, there are pluenty of boulders—hard rock of every kind but no agate. The writer would hate to say how much gas he burnt going to the upper Stillwater to fish without catching either fish or agate.

At Laurel, the Clarks Fork comes in from the south draining those huge mountains east of the park and heading in the vicinity of Cooke City. The writer has

hunted agate on this stream near Cooke City and near Bridger and Fromberg. No agates of any kind were found. The west Pryors, both Big and Little Pryor Mountains, are drained on the west by the Clarks Fork.

Agate Country Around Billings

Around Billings is the agate country but only on the south bank of the Yellowstone River are the agates found. Although there are plenty of gravel pits sunk to huge depths on the north bank as far as Forsyth 101 miles to the east of Billings, there are no agates in them except an occasional clear one. On the south bank, east of Billings, every stream, every hill, contains agate and moss agate.

Huntley is 16 miles northeast of Billings on the south side of the Yellowstone. Pyror Creek enters the Yellowstone here and rises in the Pryor Mountains to the south. The hills on both sides contain agate but further south about 15 miles the agates are all on the east bank hills.

At Pompeys Pillar, 38 miles northeast of Billings, Piney Hills rise several hundred feet to the south and are full of agates. Fly Creek enters the Yellowstone here from the south. South on Fly Creek is the small town of Corinth. West of Corinth and two miles south is the greatest agate area the writer has found in the agate country. Here are about five square miles of territory from which many tons of agates have been taken away but always the hunter can find more. It seems significant at this time to point out that the Big Horn Mountains are straight to the south and only about 30 miles away. The Big Horns are still a mighty range, one peak being over 10,000 feet high. In times past this range had probably towered many thousands of feet above this level. The Big Horn Mountains are going to satisfy the requirements of the agate country when we come to geology. The agates are found around Toluca and Hardin, the furtherest point south at any future point east. Here we have a triangle with Billings on the west, Hardin on the south, and Custer to the north (58 miles northeast of Billings). The Yellowstone River being the base of the triangle, the upper corner is a pointer to the Big Horn Mountains.

Five miles southeast of Custer is the Big Horn River flowing north. On the west bank of this river and in the hills, agates occur as far south as Hardin. On the east bank, on the hills south of Big Horn Station, agates can be found for about 15 miles south, then no more. The agate country now hangs close to the river, only on the south bank, however, Chalcedony and agatized wood can be found on the north bank, with very little agate and clear only.

Forsyth

The agates here seem to center in the river. However, there is very little to be found on the north bank while on the south bank agates occur for limited distances only, There is to be an explanation for this later on in the story.

Forsyth to Miles City to Terry

Very little agate is to be found on both sides of the river. At Miles City, however, the hunting is better on the north bank. From 10 to 15 miles out on the road to Jordan, east side, many small agates can be found and from this point east, the hills contain agate. South, due to the formation, there are a few agates but in stream beds only. From Miles City east, the agates are different in their characteristics. West of Miles City the moss has been brown and black but from Miles City east, the moss becomes to a large extent, red. Likewise the agates themselves, many of which appear to be shattered by heat. Sunday Creek is the best hunting ground in this vicinity.

The Tongue River comes in from the south at Miles City.

The Powder River, a mile wide and an inch deep, comes in from the south, near Terry, and here is a little agate shop which sells "Powder River Agates."

Terry and to the north, Cherry Creek, on the road to Brockaway. For 15 miles there are agates in a stream bed 100 to 200 yards wide. It is possible to park a car here and hunt all day without moving to a new location. Fine agatized wood and agates running into red occur here. If one tires of agates, the burnt out hills on both sides of the stream will furnish

additional interest. Here also are limonite masses, gray inside, red outside, which are easily mistaken for agates unless a corner is knocked off.

Terry to Glendive

Between Terry and Glendive, every stream has its agate, likewise its hunters. The agate is now all on the north bank of the Yellowstone, nothing but bad lands on the south. For the collector who desires small specimens suitable for ring sets, the road to Circle from Glendive, about three miles north of the junction and the low hills to the right of the road, will furnish many fine small stones of agate, agatized wood, chalcedony, and jasper.

Glendive to Sidney

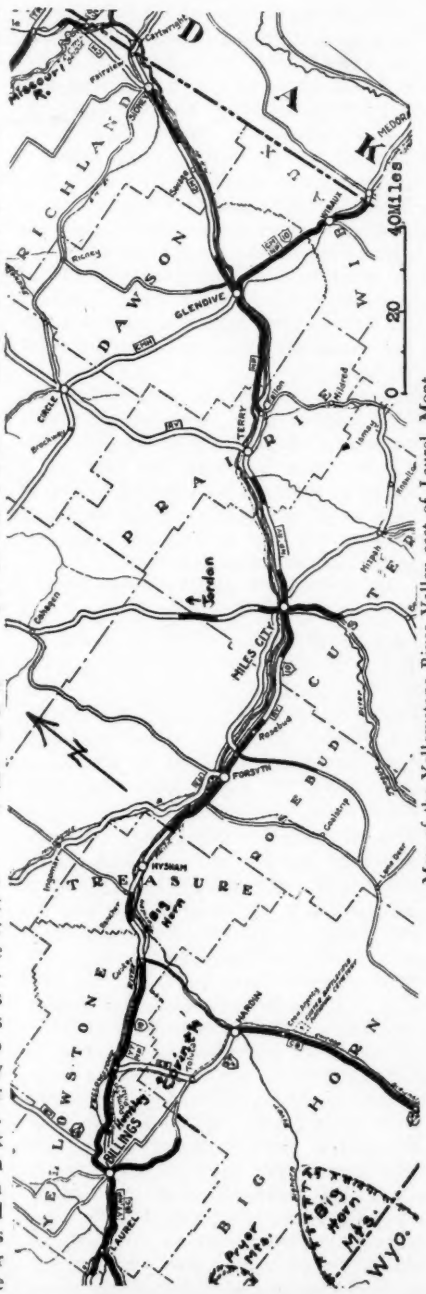
Between Glendive and Sidney is a flood plain. Agates occur in the gravel but no considerable distance out. Below Sidney and in North Dakota, the Yellowstone and Missouri Rivers join, and here is the end of agate except for those that had been carried further down stream by ice. The agates may extend down stream for several hundred miles.

Sidney and Billings End Zones for Agates

Sidney in the east and Billings in the west seem to be the end zones for agates and not the Rocky Mountains. At no point outside of the triangle, (Billings, Custer and Hardin) are agates found further than 15 miles from the Yellowstone River.

Three Types of Agates in Montana

The writer is familiar with three types of agate, seam, ledge, and nodular. It is the nodular agate that the writer speaks of as being the Yellowstone Agate—no corners, smooth on the outside, and with a crinky surface. This type of agate comes from a lava—gas pockets that have allowed silica to creep in and harden. Rhyolite and Porphyry are two lava rocks in which the writer has found agate in matrix in Montana. Take any bar in the Yellowstone, pick up 50 small boulders, break them open and 50 per cent will be porphyry. In only one instance has the writer found rhyolite in the Yellowstone and that was a small piece from Cherry Creek near Terry. While numerous deposits of agate



Map of the Yellowstone River Valley east of Laurel, Mont. (Topography from *Montana*, Resources and Opportunities Edition, Helena, Mont., 1928)

in matrix are known to the writer as occurring in Montana in no other instance has agate been found in any other matrix.

Ledge agate occurs near Helena in a long ridge of jasper and semi-opal and also an agate-jasper breccia. Near White Sulphur Springs, nodular agate occurs in porphyry. On the Lamar River in Yellowstone Park, chalcedony occurs in rhyolite. In Rattlensake Gulch, between Helena and Lincoln, chalcedony occurs in rhyolite. South of Cardwell, on one side of a valley, agate and bloodstone are found in porphyry, and across the valley about one-half mile agate occurs in rhyolite.

From the evidence of the sand bars, the Yellowstone agates were formed in gas pockets of porphyry and the lava flow was not from the Rocky Mountains either south or west of Billings but appear to have originated in the:—(here the writer believes you will quit if the solution is given so wait for further details).

No Evidence of Agates Coming From Rocky Mts.

From the foregoing the writer is able to state that there is no evidence to be found, in valley or stream bed, that the Yellowstone moss agates came from any part of the Pryor Mountains, Bear Tooth, Absaroka, Gallatin or Crazy Mountain Ranges. This observation is not based on hearsay but actual hunts for agate either on or near these mountain ranges. This eliminates everything as a possible source, on a line west of Billings. However the agate is east of Billings and it just didn't happen. The next step in the elimination of possible sources is to consider the geology over the which the agates are found.

Geology of the Area

During the Cretaceous Period, Mesozoic Era, seas covered all of the state of Montana, and many adjoining states, from the gulf to the Arctic Sea. The Cretaceous Period lasted for 70,000,000 years and during this time large continental deposits were laid down on the present site of the Rocky Mountains to a depth of between 20,000 and 30,000 feet. During the latter part of this period, folding began in that part now covered by the Rocky Mountains causing the eruption of active volcanoes over the Yellowstone Park area, and numerous other states. Likewise during the closing years of the Cretaceous, water depths were not the same but are marked in different ways. In Texas, deep water is indicated by the deposit of limestone hundreds of feet in depth. In Montana, a mud, turning to shale, indicates that the seas were shallow and near land. During the last of the Cretaceous Period, the Bear Paw shale was deposited even while other activity was in progress elsewhere. The Bear Paw shale consists of shale only and any previous formations laid down before this shale need not be considered. Overlying the Bear Paw shale is the Lance, a formation of shale and sandstone. Nothing is in this formation that would favor the forming of agates. Overlying the Lance, is the Fort Union. This consists of sandstone, shale and lignite. Lignite in this formation indicates that there was a heavy vegetable growth either in fresh or brackish water. In some parts of Eastern Montana these coal beds were thousands of years in being laid down. Also in the Fort Union sandstone there is plenty of limonite in nodules, red to brown in color. However there is no formation that would favor the forming of agates.

Formations below the Bear Paw shale are: Judith River sandstone. Below the Judith River sandstone is the Clagget shale. Below the Clagget shale is the Eagle sandstone which forms the high bluffs at Billings. West of Billings and on the south bank of the Yellowstone River the Colorado shale appears. Formations further west than Billings will not be considered, the Kootenai-Morrison, sandstone and shale and the Ellis, also sandstone and shale. Coming into Montana from the east via Wibaux, the Lance formation is struck in the form of bare walls. At Glendive the Yellowstone flood plain is reached. There is an anticline 11 miles west of Glendive, a dip in the rocks east and west which happens too far to have any bearing on the agate source. From Glendive to Miles City, the Fort Union formation appears in the form of bad lands, clinker hills from

burnt out coal beds and red limonite. Gravel containing agates overlie all these hills and it is among these hills that the burnt agate is so prominent. The red moss in these burnt agates is due no doubt to iron oxide seeping through heated seams in the mineral. Now the Bear Paw shale appears, running almost to Billings on the north bank of the Yellowstone, to be exact, north of Huntley. On the south bank between Miles City and Hysham, burnt out coal beds extend for many miles south and where the Fort Union formation doesn't appear, the Lance sandstone and Bear Paw shale appear. Except over the Bear Paw shale, gravel covers all the hills.

An Uplift Between Huntley and Billings

There is one other possibility here in the form of an uplift between Huntley and Billings, a distance of 16 miles.

At Huntley the dip of rocks is east. At Billings the dip of rocks is west. This uplift is a continuation of the Pryor Mountain uplift further to the south. However there is no evidence to be found where there might have been a break through of lava and only sandstone and shale are to be found. The collector may wonder why gravel and agate appears on such high hills as Piney Ridge, several hundred feet above the river. This is explained by the fact that the erosion in eastern Montana has been as much as 2500 feet. In the vicinity of Billings, on an estimate of the Bull Mountains, between 1000 and 1500 feet had been eroded so that high hills along the Yellowstone were at one time a flood plain, and the gravel deposited there, with the exception of agates, really did come from the mountains to the south and west.

Southern Boundary of Ice Sheet

The Cretaceous Period, followed by folding of the mountains, volcanic action, and the movement of volcanic dust, all happened before the ice age and a great many collectors will immediately say that the ice sheet was responsible for the agates being brought to the Yellowstone Valley.

The ice sheet, moving down into Montana from the north, moved as far south as the Missouri River which ran along its southern edge. From the boulders to be found in northern Montana, the southern movement of the great ice sheet can be accurately followed. At no place did it ever move further south than the valley of the Mussellshell River. There is no evidence that it ever reached the Mussellshell. Between Circle and Wolf Point, 20 miles south of Wolf Point will mark the furtherest south, and this is south of the Missouri. The writer is not able to say where the Missouri flowed when the present channel was blocked south of Wolf Point. Further, the writer has hunted agates between Wolf Point and Circle. There are none. Likewise between Fort Peck and Circle. There are none. From Circle to Terry. Not until Cherry Creek is reached and 15 miles from Terry are there any agates to be found. Between Great Falls and the Dakota line, along highway No. 1 and the Great Northern Railroad, the glacial drift has built moraines over the underlying formation. However, the Missouri River cuts show that the underlying formation is the Bear Paw shale. The writer is able to state from many personal observations that the Yellowstone agates did not come from the north through the agency of the ice sheet.

The writer has a healthy respect however for the movement of objects, such a rocks and agates in particular, by ice movement.

Boulders Moved by Ice and Water

In the Yellowstone Valley, Billings to be specific, the temperature ranges from 40 below to 113 above zero. During one winter the thermometer went to 35 below zero and for 16 days never got higher than 10 below. During this period of cold, the river froze over to extend the frost line down into the ground a distance of eight or ten feet. When the thaw came, rising water bodily lifted the ice and all that was clinging to it underneath, and moved off down stream carrying its load of rock. It might have grounded several hundred miles down stream before it came to rest, there melted and left a pile of several hundred pounds of gravel. The writer has seen many instances of this movement in the

shape of piles of rocks left on sand bars after the spring high water had passed.

Summary and Conclusion Concerning Origin

To sum up the writer then offers the following::

1. The possibility of agates coming from the west, north or southwest of Billings, is not borne out by any evidence that can be found.

2. That Billings is the western end zone for moss agates.

3. That the greatest amounts of agates are to be found in the Billings-Custer-Hardin triangle and extend further south here than at any other point along the south bank of the Yellowstone.

4. That there are no moss agates along the north bank of the Yellowstone for almost 100 miles east from Billings.

5. That the agates are formed in a lava, either rhyolite or porphyry, and the absence of rhyolite indicates that porphyry is the matrix.

6. That there is no geologic formation in the area covered by agates that are igneous in any way and not favorable for agate forming.

7. That the uplift between Huntley and Billings is intact and not a break through of lava.

8. That the geologic formations previously discussed not only follow the Yellowstone Valley but extend to the Mussellshell Valley from a point north of Billings (Roundup) east to Miles City and beyond the state line.

9. That the same statement also applies to the country south of the Yellowstone to the Wyoming line—with one exception: The Big Horn Mountain Range in Wyoming.

From the foregoing, the writer wishes to advance the theory that the moss agates of the Yellowstone Valley, between Billings and Sidney, in Montana, were originally formed in porphyry, the source some place on the north end of the Big Horn Mountains, and moved by local glacial action from the Big Horn Mountains, north to the Yellowstone Valley, deposited there upon the original flood plain and distributed east by local action of river ice and flood water.

The Big Horn Mts.

The Big Horn Mountains extend from a point near Casper, Wyoming, running north, to a point about 15 miles inside Montana. This range of mountains was lifted as part of the Rocky Mountain disturbance and probably was at one time many thousands of feet higher in elevation. During the ice age, local glaciers were formed on every mountain range of the western United States which extended as far south as Mexico. A proof of this is the Big Bend Agates that had been carried almost to the Gulf of Mexico down the Rio Grande Valley between Texas and Mexico. The distance in this case is several hundred miles. Ice breaking from large glaciers with their load of rocks, carried by flood waters, can transport their cargo for long distances before being grounded and melted.

The gravel beds in Montana that cover the hills of Bear Paw shale have been all deposited on the surface and kept sinking with the land levels. Glacial action from the Big Horn Mountains as a base would spread fan wise and in this manner easily reach the site of Billings, the west end zone for agates.

Stream beds offer no obstacle to the movement of large glaciers and their being in the line of march at the present time means exactly nothing in calculations.

The Pryor Mountains, south of Billings and west of the Big Horn Mountains, are not igneous, that is, no igneous formations are found in their vicinity, on their sides or top. Likewise the Wolf and Rosebud Mountains, east of Hardin and south, are not igneous but rather original levels. The Bull Mountains between Billings and Roundup also are original levels, the Fort Union formation is right on the surface near the summit. By the process of elimination, there remains only the Big Horn Mountains which were folded, contain the matrix, porphyry, necessary to favor the forming of agates. The answer to the Yellowstone agate mystery is believed to be the Big Horn Mountains.

Acknowledgment

In closing the writer wishes to credit Daniel E. Willard, A. M., author of the book: "Montana, The Geological Story" for much valuable information used on the geologic formations in Eastern Montana. He recommends this book to all interested in Montana geology. It is printed by The Science Press Printing Company, Lancaster, Pennsylvania.

AN ICE CAVE IN WASHINGTON

By B. J. FRITZ

Seattle, Washington

In the Saddle Mountains in the southern part of Washington is a peculiar geological formation. It is called an ice cave but it differs from other known ice caves in that man has provided the cave part and Mother Nature furnishes the refrigerant. It was originally a 12-inch opening at the base of the mountain 550 feet above sea level and from this hole comes a strong blast of frigid air that even in the hottest weather is considerably below freezing. This phenomenon was discovered by a rancher named Jackson in 1910 and shortly afterwards he and a neighboring rancher proceeded to excavate a cave in the side of the mountain approximately 14 feet long, 8 feet wide, by and 8 feet high which was timbered and boarded up. The frigid air blower is in the rear and the cave has a door 6 inches thick and though no use has been made of the cave for some time, it is still equipped with racks and hooks on which the ranchers used to hang their dressed beef, etc. It would be a wonderful place for a thirsty rock hunter to cache a few bottles of something but unfortunately there is no lock on the door.

One peculiarity that invites scientific investigation is the fact the water in a newly dug well 80 feet deep and 6 miles distant, froze solid over night in August which shows that the strata of cold air must extend a considerable distance. No one seems to know from where this volume of freezing air under pressure comes from although several old timers have advanced theories all of which are probably wrong.

They insist, however, that the air in the cave is colder in summer than in the winter and that a block of ice formed in the cave from frozen seepage will outlast a block of artificial ice of equal size, three to one, when placed together outside in warm weather.

This cave is within 200 yards of highway (Crab Creek Road) and is 6 miles east of the village of Beverly, Wash., (in the southwestern part of Grant Country) where the Milwaukee R. R. crosses the mighty Columbia River.

In addition to the ice cave, the Saddle Mountains are a very prolific source of petrified wood, some of the varieties being black walnut, elm, cypress and gum.

Agates Found Recently in Costa Rica

Some very fine grayish-blue agates were found recently in the Province of Lemon, Costa Rica, about 8 miles from the port of Lemon on the Caribbean Sea. Just how extensive the deposit is has not been revealed but judging from specimens seen in the office of the Consulate General of Costa Rica, in New York City, the agates occur as waterworn pebbles and small boulders and are of excellent gem quality. We hope to obtain more information on the deposit.

Delightful Little Rocks and Minerals!!

What a pleasure in these distressing days to be carried into the ever absorbing atmosphere of natural grandness, which include any little mineral specimen.

No matter what we lose we shall always have nature!

Mrs. W. E. Britton.

CHALCEDONY AT MADRUGA, CUBA

The municipality of Madruga is situated on the Central Highway, 66 kilometers[1] southeast from the city of Havana, in the eastern part of Havana Province. Havana Province is in the eastern part of the island of Cuba.

Chalcedony occurs in a region around Madruga which covers an area approximately six square kilometers; this region is surrounded by isolated hummocks and stratifications of chalk and serpentine. Deposits of chalcedony in this region are to be found in the following places: Chivo hill, Copey hill, Jiquima hill and down the slopes of the latter even to a small distance beyond the town cemetery.

The distance from the center of Madruga to the summits of Chivo and Copey hills is about 2½ kilometers, while the center of the summit of Jiquima hill is 4 kilometers from the town.

The highest points of Chivo and Copey hills scarcely reach 100 meters above the level of the highway as it passes through Madruga. Jiquima hill rises to a height of almost 300 meters. A deep, abrupt ravine separates Jiquima from Copey; the directions of the axes of these hills are oblique to each other.

The foundation of these three hills, Jiquima, Copey, and Chivo are formed of serpentine. The chalcedony appears only in small groups of rock masses of a few cubic meters in size on the hills. This chalcedony is of interest to mineral collectors because of its beauty and variety of forms and is found in sizes from small up to those weighing 25 pounds or more.

A chalcedony deposit in mass appears like an enormous rubbish heap in which various forms of the mineral are imbedded in large quantities of very ferruginous clay. In general the chalcedony is cream colored, (white to milk-white when broken), stalactitic or geodic. Some of the chalcedony is a shapeless, dirty, ugly stone but it often carries within it the architectual marvels of crystallography which tell the mineralogist of the Creator's wisdom. At times small crystals line the walls of geodes, like snow; in other instances the most beautiful stalactites surprise us showing a covering of the purest rock crystals; again there appears a pure white column of stalactite which did not have time to become a mass with a geode; still on other occasions we see a viscous, blackish oil ooze out of the cavities of chalcedony; still again we find in the center of a chalcedony a resin, solidified and highly fragrant like incense; finally, after much striking a stone permeated with a yellow, powdery earth, there appears, as if by magic, the precious miniature of a cave with its stalactites, stalagmites, and in the center a most delicate column about the size of a match—truly a specimen unique for Cuban minerals.

In the deposits around Madruga striped green chalcedony also occurs and so does a ferruginous variety which is streaked brown with peculiar thin plates of cristobalite (?) interposed. Other minerals to be admired in Madruga are blue, opalized quartz which at times is cuboid and agate.

Finally let us recall the existence of numerous external impressions in some of the chalcedony in which may be seen the negatives of crystals which have disappeared; an American mineralogist considered them to be impressions of valencianite crystals of the adularia variety.

Prepared for Rocks and Minerals
by an enthusiastic collector
of Madruga chalcedony.
Havana, Cuba.

[1] A kilometer equals 3,280.8 feet; a meter equals 39.37 inches.

Mineral Fluorescence

(*Continued from page 318*)

this light; and with it, many specimens not otherwise worth showing become interesting and even spectacular. In addition, all specimens activated by near ultraviolet have many times their former brillance.

Accordingly, I consider this Ultraviolet Spotlight to be the most useful single piece of apparatus available for fluorescent mineral displays, though, of course, a cold quartz lamp must be had in addition if all minerals are to be included.

NOTES ON THE QUARRYING AND PREPARATION OF SOME SLATE PRODUCTS

By MARY S. SHAUB

A reader of "Rocks and Minerals" would, as a rule, be more or less disappointed upon opening a number of the journal if he expected to find articles on rocks. The reason is obvious, for stories of minerals are usually far more interesting to its readers as well as to the average layman. Nevertheless, some rocks, if not of value in themselves as cabinet specimens, are interesting in their occurrence, mining and preparation for industrial uses. An outstanding rock in this respect is slate, which at the present time finds its way into many common everyday applications.

Slate owes its origin to a rather intense dynamic metamorphism of rocks originally made of clay, and consequently slate deposits are found only in those regions where the rocks have been intensely folded. The five major slate producing areas in the United States are located along the northeastern Atlantic seaboard and are as follows: 1.) Central Maine near Monson; 2.) Vermont-New York slate belt; 3.) Eastern Pennsylvania slate belt; 4.) Peach Bottom (southeastern Pennsylvania) slate district; 5.) Virginia districts. Last summer the writer visited several quarries in the famous Peach Bottom area near Delta, York County, Pennsylvania. The most complete operations in this area are those at the Funkhouser Quarries where the slate is both quarried and finished in a number of ways. The quarrying operations are both open pit and underground.

About three decades ago, when many prepared roofing materials were introduced to builders, the increased cost of operating the old open pit slate quarries together with the ever-growing hazards attending the deeper quarrying operations forced many of the quarries to close down. The recent introduction of modern heavy duty gasoline trucks, electrical equipment, modern channeling and wire sawing methods, and new uses for the non-splitting slate have again placed some of the Peach Bottom slate quarries in the ranks of commercial producers, first by using parts of the waste slate of the dumps which is ground into granules and dust and second by the resumption of even more extensive quarrying. Granules consist of the crushed slate which has been reduced to sizes around 1/16 to ¼ inch and graded to a uniform product. To keep the product in harmony with different color schemes in building, the granules are often dyed green, red or brown by various processes. In some districts, as in Vermont, the slate has distinctive colors in which case it can be used without the artificial coloring. Some of the naturally colored granules and even some of the dyed granules fade when exposed to the weather and intense sunlight. The slate dust, which is exceedingly fine-grained material, has wide usage as a filler in paint, linoleum, rubber etc. and as a filler in asphalt used for various construction purposes.

At the Funkhouser Quarry work is continuing in the old quarry location but instead of the former glory hole operations inclined truck roads have been built and several of the separate glory holes have been combined. In one section a large underground tunnel has been blasted and stoping operations are now being carried on. This method is much safer than open pit methods as pillars can be left to support the ceiling during further quarrying.

Areas of badly fractured slate are blasted in the usual way with dynamite whereas the good roofing slate is quarried with sufficient care to preserve the material in large blocks as much as possible. To this end the workmen use black powder for blasting rather than the more powerful dynamite which severely shatters the rock. The black powder, however, must be handled with extreme care. (Fig. 1). The explosion of the powder is accompanied by huge spurt of flame from the drill hole.

The broken slate is hauled to the crusher in trucks and in narrow gage rail-

way cars drawn by a small gasoline locomotive. The roofing slate is delivered to the finishing mill where the large slabs are first split by hand wedging to about 6 inches in thickness and then laid on a horizontal table for sawing (Fig. 2) which is done with a slowly rotating toothed circular steel saw about three feet in diameter in the same manner as a wooden plank is sawed except that water is run on the slate saw to keep it cool. The sawing is not difficult as the slate consists of relatively soft minerals more than 50% of which are muscovite and chlorite which can be cut with considerable ease.

From the sawing table the slabs go to the workmen who split the slate to about 3/8 inches in thickness. (Fig. 3). The irregular pieces are then cut to standard sizes by operators at power-driven shears which consist of huge guillotine-like knives, (Fig. 4). Considerable experience is required in deciding what dimensions are best for the particular piece of slate at hand. The material so finished is stacked in piles according to size and quality. For ordinary roofing the smooth material is used but in special cases an "antique" effect is desired and for this purpose the rougher slates are used. The final process is that of punching slates according to specifications from contractors. The punching process is done by workmen at manually operated punching machines activated by foot power.

Slate probably has more distinct and special uses than any other of the com-

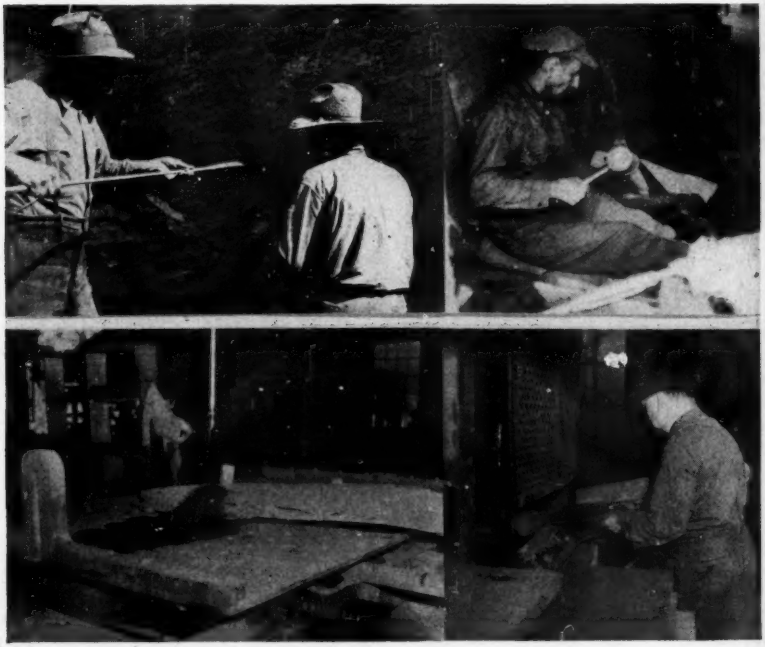


Fig. 1 (upper left). Cautiously loading black powder in a hole drilled in good quality roofing slate.

Fig. 2 (lower left). Sawing a slate slab with slowly rotating water-cooled saw.

Fig. 3 (upper right). Splitting roofing slate to a thickness of about 3/8.

Fig. 4 (lower right). Final trimming of roofing slate to proper dimensions.

mon and abundant rocks. We all are familiar with the line of blackboards around two or three sides of the school room. These are simply large pieces of slate which have been split and ground to a smooth matt surface. Similar boards are common in the larger railroad stations where the arrival and departure of trains are posted. Again, similar pieces of slate having proper dielectric properties are used extensively for switch and instrument boards in power houses and other electrical control stations.

Away back in grandfather's school days a thin piece of slate either with or without a frame was used exclusively for 'ritin' and 'rithmetic. The pencil for marking on the slate consisted of a piece of much softer slate shaped like an ordinary pencil only it was much thinner. When the student's work was acceptable to the teacher the writing and figures were removed from the slate by using a damp cloth or sponge. The children of today may rightly lament the passing of the dear old school slate from which the cartoons of Jimmy and Sally or even the teacher could, with a single swift swish of the sponge, be destroyed forever with not even a trace for evidence.

Another use of large smooth slabs of slate is that of making billiard and pool tables which require a hard and even surface over which the billiard felt is stretched. Many additional uses may be mentioned among which are burial vaults, shower partitions and flooring in gymnasiums, sinks, stair treads, base boards and flagging.

In some localities the action of dynamic metamorphism is so severe that the process continues past the phase where slate is produced from the earlier shales or clay muds, in which event a schist is produced instead of a slate. The increased metamorphism often produces a number of fine minerals among which are staurolite, chiastolite and garnet. The staurolite and garnet are often developed as complete crystals and these may be readily removed from the enclosing rock. Hence, this seemingly uninteresting rock is one of the many which should create more than passing interest to those collectors who are devoted to the various phases of geology.

AN ICE CAVE IN ARIZONA

By WENDELL O. STEWART

In response to request for information on ice caves, there is one in the Sunset Crater National Park, Arizona, which I visited several years ago, and which are a short[1] distance by a good automobile road from Flagstaff, Ariz. The 3000 acre park is well described on page 286 of the new handbook *"Arizona, A State Guide* of the American Guide Series. The park surrounds an extinct volanco. The caves were caused by the mass of lava cooling so unevently that a crust formed on the top while the material below was still molten. As this fluid lava drained away, caves were formed in the solid material that remained. Because lava is a poor conductor of heat, the cold air at the bottom of the intercone basin is protected. No matter how high the temperature is outside, within the ice caves there is snow on the floors and ice clinging to the ceilings.

1 About 16 miles northeast of Flagstaff in north central part of the state.

STILL TIME FOR A LONG TRIP

Summer is not over as yet so collectors have lots of time to make a long trip to some noted mineral localities. But plan your trip so that at least one stop may be made at some dealer's establishment where you will find many nice minerals on display. Localities are often disappointing but a dealer's stock never is.

Look over the advertising pages of this magazine for names and addresses of dealers.

NEW ENGLAND NOTES

Conducted by Rudolf C. B. Bartsch
36 Harrison St., Brookline, Mass.

Roxbury Station, Conn. The old siderite mine is posted and fenced in with barbwire but apparently no effort will be made to keep collectors off the property. It is recommended, however, that collectors stop at the hardware store near the station to obtain permission for going on the property.

A visit made to the locality on Thursday, August 8th, 1941, resulted in the collecting of many fine specimens of siderite, some good galena, sphalerite, and quartz crystals. One of the best areas for collecting is in back of the furnace (about 500 feet from the road) near the base of the old grading.

The old furnace plant was over half demolished. One tall stack was still standing but was so undermined that a good wind should blow it down. From inquiries made it appears that boys had created much havoc to the historic old plant so that some of the tottering structure had to be torn down.

Roxbury Station (on Conn. 67) is on the west bank of the little Shepaug River and the old abandoned station is about 200 feet from the bridge.

Roxbury Falls, Conn. The old garnet mines are still productive of good specimens though much search is necessary to obtain them free from iron stains. Some of our best specimens (collected on Sunday, August 10th, 1941) were found in the field near the top of the main pit (there are four pits). Garnet (almandite) is so plentiful that hardly a rock can be picked up without at least one crystal imbedded in it. Some good staurolites were also found. The rock of the mine is mica schist.

To reach the locality, head first for Roxbury on Conn. 199 (a few miles east of Roxbury Station) and then go south to the very end of Route 199 which is a good macadam road. (Roxbury-Southbury town line is at end of Route 199). The road continues but is now a dirt road —go on it for ¼ mile (.25 miles) and then take the first dirt road to the left which goes up hill, a very poor and winding road. Keep to right for ¼ mile until an old house on the right is reached (Lyman Green's) where you stop and park. Permission to enter the mine property must be obtained here for which a fee of 25c per person is asked. The pits are 500 feet to left of the house; the dumps are easily visible from this point.

The road to left which branches off Green's road runs for a few hundred feet to stop at another old dump whose material is used as fill for roads of the district.

NOTE: Do not try to reach the property over any other road as all roads except Route 199 are in a horrible condition.

Above notes contributed by Peter Zodac

CLUB AND SOCIETY NOTES

Bridgeport Mineral Club

The 5th field trip of the year will be held Sunday, Sept. 21st, at the amethyst locality at Canton, Conn. The trip will start from the Central High School, Bridgeport, Conn., at 9:30 a.m.

For further particulars contact Mrs. Julia Walker, Sec., 55 Eaton St., Bridgeport.

New Haven Mineral Club

The 6th field trip of the year will be held Sunday, Sept. 21st, at the famous old pegmatite quarry at Branchville, Conn. The group will meet in front of the Peabody Museum on Whitney Ave., New Haven, Conn., at 9:00 a.m. from which point it will proceed to the locality.

NEW HALL OF GEMS AND JEWELS AT FIELD MUSEUM

The Hall—

A "gem of a room" for the housing of one the world's most complete and valuable collections of gems and jewels—that was the aim of the administration of Field Museum of Natural History, Chicago, Ill., in completely "doing over" H. N. Higinbotham Hall of Gems. The priceless treasures were removed to storage last September, and ever since then the task of completely rebuilding the hall architecturally and as to style of exhibit installation and lighting has been under way. The gems and jewels, with the addition of a number of new specimens, are now reinstalled in a manner that brings out their full beauty of color, luster, and brilliance as never before.

The renovated hall, with its "jewel-box" cases of English harewood and polished bronze which rival the gems themselves in brightness and sparkle, was reopened to the public on Friday (JUNE 20). The latest type of illumination by means of concealed fluorescent light tubes, concentrating light on the gems and jewelry all of which have been freshly polished and artistically arranged, has been employed. High on the wall facing the entrance is a stained glass window by Tiffany which represents a mermaid rising from the sea. The collection is so arranged that the visitor enters between cases containing the most precious stones, and proceeds thence to the less valuable semi-precious and oranamental stones.

The original, and major part of the collection of gems and iewels was presented to Field Museum by the late Harlow N. Higinbotham, a prominent leader in Chicago civic affairs during his lifetime. Mr. Higinbotham was a trustee of the museum from 1894 until his death in 1919, and was the second president of the institution, serving in that capacity from 1898 to 1908. Additions to the collection have been made from time to time by other contributors, by museum expeditions, and from other sources.

The Collection—

Nearly every known variety of precious and semi-precious stones, both in the finest cut examples and as crystals, cleavages, and rolled grains, is displayed. Many of the specimens are distinguished for their historic interest. Almost every part of the world is represented.

Shown also are examples of the better kinds of ornamental as distinguished from precious stones. Each of these is shown in the rough, as well as in plain polished form or in carvings.

Supplementary collections illustrate the folk lore of precious stones, and show some of the native forms of gold, silver and platinum because of their importance as the metals in which jewels are usually mounted.

Magnificent examples of the goldsmith's art, from ancient Egypt and Babylonia, from India, from Colombia, from the tribes of Africa, and elsewhere are included.

Side note: "Gems and jewelry have always been of human importance and interest, whether as signs of wealth and social position, as means of personal adornment, or as symbols, charms and fetishes in various forms of religion and superstition," comments Dr. Paul S. Martin, Chief Curator of Anthropology at the Museum. "They therefore form a major element in the study and history of mankind, both for the archaeologist and the ethnologist. Practically every culture, primitive or civilized, ancient or modern, involves their use in one form or another."

Side note: "Jewelers divide gems worn for personal adornment into two classes, precious and semi-precious," observes Henry W. Nichols, Chief Curator of Geology. "They regard the diamond. emerald, ruby and sapphire as more valuable and attractive than other gems and class them as the only truly precious stones. All other gems are classed as semi-precious. This division, however, is arbitrary, since a semi-precious stone of high quality may easily outrank in beauty a precious stone of inferior grade. Stones rarely used for personal adornment, but used for other decorative purposes, are called ornamental stones. Pearl, coral,

amber, and jet, which are of organic origin and not technically stones at all, are classed with the semi-precious and ornamental groups."

Side note: Chief Curators Nichols and Martin, and their associates in their respective departments, are jointly responsible for installation and annotation of the gem collection.

The Precious Stones:—

All of the truly precious stones are represented by numerous examples. The most interesting of the diamonds is one which has engraved upon it in intaglio a bust of King William II of Holland. This 10-carat stone is pear-shaped and half an inch long. The engraving is so delicate that it has been necessary to mount a magnifying glass over it. It is the work of the famous diamond cutter, DeVries, of Amsterdam, and the work consumed all of his spare time for five years.

There are many blue, yellow, and white sapphires and rubies from Ceylon, Burma, Russia, Brazil, and North Carolina. There are six large star sapphires, three of which weigh more than 130 carats each, and two good star rubies. With the cut emeralds are uncut crystals of the gem, among them three from Brazil from three to five inches long of rich emerald color with many transparent portions.

Side note:—The modern internationally adopted metric carat has a fixed weight of 200 milligrams (1/5 of a gram); in English weights this corresponds to about 3 grains; a Troy ounce contains about 155 carats. The name "carat" is said to be derived from a variety of locust tree which has seeds of uniform size used for weighing gems in olden times. Until comparatively recent years, the value of the carat has varied in different countries.

Side note:—"Star gems" usually show four- or six-rayed stars as a result of an optical phenomenon known as asterism. The stars are formed by the intersection of bands within the gem caused by certain types of very finely fibrous structure.

The Semi-Precious Stones:—Many of the finer of these display such brilliancy and color that one may well wonder why they have been classed as semi-precious rather than precious. In the Museum collection these are present in such great variety that only a few outstanding ones may be mentioned. Examples of star garnet and star quartz are included. A series of blue, white, pink, and golden cut topazes is unusually choice and complete. A gigantic topaz crystal with nearly perefct clearness and transparency weighs 90 *pounds.*

Other noteworthy semi-precious gems are the numerous beryls and aquamarines which differ from the emerald only in color. The largest is the unusually perfect Crane aquamarine which weighs 341 carats; oustanding also is the Hope aquamarine of 331 carats. The several varieties of precious opal are given adequate representation. Most remarkable of these from a historic standpoint is the Sun God Opal which was kept in a Persian temple for three centuries. It may have been connected with the worship of the sun. It is carved to represent a human face and is mounted in a cup of gold inscribed with black figures of Oriental design. The resemblance to a miniature sun and its rays is striking. The opal is of Mexican origin but the carving does not seem to have Aztec characteristics.

The collection includes also a comprehensive representation of the chatoyant gems characterized by soft, wavy, silky light which seems to come from the stone's interior. These include such stones as adularia, moonstone, cat's-eyes and quartz cat's-eyes.

The better kinds of ornamental stones such as alabaster, selenite, and agate are also shown in rough and in carved forms. Moss agates, which appear to contain landscapes, are featured.

Jewelry of Historical Interest:—

The oldest pieces of jewelry in the museum collection are of lapis lazuli and gold, and come from Kish, the ancient Babylonian city excavated in Iraq by the Field Museum-Oxford University Joint Expedition. These are dated at 3000-2500 B. C. which means they were made 500 or 600 years before Abraham. There are also ancient pieces of gold jewelry, some with brightly colored stones from Egypt, dating from the Greco-Roman

period (3rd Century B. C. to 4th Century A. D.). Fine examples of the goldsmith's art from the 7th to the 5th centuries in Etruria are also shown.

Ancient American gold jewelry from Peru and Colombia, made about 500 A. D. or a thousand years before Columbus sailed westward, constitutes another division of the collection. Then there is the more modern (in point of time) jewelry of India, characterized by delicacy of workmanship, lavish use of color, and especially noteworthy for filigree work. From Algeria are shown examples of gay massive jewelry which in size, if not in its flashy imitation stones, puts to shame current modern costume jewelry.

Superstitions Surrounding Gems:—

According to ancient popular beliefs in India, certain precious stones possess special magical properties. Agate is supposed to strengthen the heart, cure snake bites, and is a charm against the plague. Carnelian insures victory; coral keeps away evil spirits; diamonds calm anger—instances of their use for this purpose are not unusual in modern American domestic situations, although candy or flowers are more practical for most folks. The opal preserves one from malaria, but alas, it is also fatal to love, and sows discord between giver and recipient. However, fortunately, the emerald counteracts the discord caused by the opal, and promotes friendship.

ICE CAVES IN NORTHERN CALIFORNIA

By MRS. EDITH McLEOD

About forty miles south of our city of Klamath Falls, Oregon, in the Modoc Lava Beds of northern California, now a National Monument, there are a number of caves where ice lasts the year around.

One of these is Crystal Cave, noted for its groups of ice stalagmites. It is a very deep cave and difficult of access and exploration. Some of the lower galleries, deep underground, are called "jewel chambers" from the fact that the red lava walls are covered with frost crystals which flash like diamonds in the lantern light.

Skull Cave is one of the largest in the region in height and breadth. The beautifully domed roof is 75 feet above the floor level. There are three levels, the lower one being a river of perpetual, solid ice, in which have been found embedded the bones of bighorn sheep and pronghorn antelope, now extinct in this region. It is from these bones the cave derived its name.

Frozen River Cave is the largest ice cave in the Lava Beds and contains a river of ice several hundred feet in length and of unknown depth, which seldom melts.

Then there is Bear Paw Cave, a cave of several levels, with a frozen river and a frozen waterfall; and Captain Jack's Cave where the Indians chopped out ice during the Modoc War. Captain Jack was the leader of the Indians. And Cox's Ice Cave, Caldwell Ice Cave and Upper Ice Cave are others in this same region; and just outside of the Monument is Iceberg Cave.

There are also other caves and crevices not so well known where ice persists the year around. One of these is what looks like a large crevice from the surface, but stages in early days use to stop there while the driver descended (with some difficulty, I'd say—I tried it once) for ice, as did also the few local settlers of that time.

Near Bend, in central Oregon, are two ice caves, Arnold Ice Cave and Edison Ice Cave; and in the northwestern corner of Lake County, Oregon, is located South Ice Cave.

Take your winter overcoat and galoshes along if you are going down.

BIBLIOGRAPHICAL NOTES

California Journal of Mines and Geology: The Division of Mines, Department of Natural Resources, under the direction of Walter W. Bradley, State Mineralogist, announces the release of the January, 1941, issue of "California Journal of Mines and Geology," being Chapter 1 of State Mineralogist's Report XXXVII (200 pages, illustrated by photos, cuts, and maps).

This chapter contains a report on the Mineral Resources of Trinity County, by Charles V. Averill, District Mining Engineer, Division of Mines, Redding. This is accompanied by a map of the county showing the location of mines and prospects.

The Geologic Branch presents a timely paper on "Strategic Minerals Procurement," by Charles W. Merrill, of the U. S. Bureau of Mines. There is also a report on a "Geologic Investigation of the Chromite Deposits of California" by John Eliot Allen, which represents a study of approximately 213 separate chromite orebodies occurring in more than 75 separate localities in the State.

Two special articles titled "United States Supreme Court Renders Far-reaching Decision on Power Permits on 'Navigable' Streams" and "Securities and Exchange Commission" are included, as well as the usual notes on Statistics, Museum, Laboratory, and Library.

Price 60 cents postpaid, plus 2c sales tax to residents of California. All publications of the Division of Mines are for sale at its San Francisco, Los Angeles, and Sacramento offices.

Pamlico Fossil Echinoids: By Willard Berry.

In the Pamlico formation of the Southern Atlantic Coastal Plain, a new species *Encope micheline* L. Agassiz has been found associated with *Mellita quinquiesperforata.* The new species is briefly described in this paper.

Issued by the Smithsonian Institution, Washington, D. C., as part of Proceedings of the U. S. National Museum, Vol. 90, No. 3113, 3 pp., 3 full page illus.

Contributions to the Data on Theoretical Metallurgy: By K. K. Kelley.

The purpose of this bulletin is to give the available values of the entropies at 298.1° K. of the elements and inorganic compounds, together with enough explanation of the methods employed in calculating entropies to make the results comprehensible.

Issued by the U. S. Bureau of Mines as Bulletin 434 (115 pp.). For sale by the Superintendent of Documents, Washington, D. C. Price 15c.

Mines and Minerals in Brazil: By Josias Leao.

Brazil, the largest country in South America and known the world over for its wide variety of gem stones, is literally a store house for minerals. Most collectors have some minerals from this great country in their collections but very few of them know much about the localities from which their specimens came from. We are very sure, therefore, that *Mines and Minerals in Brazil* (published in Brazil but printed in Englsh) will be a welcome addition to a collector's library.

The bulletin is 7x9 inches in size, contains 243 pages and has a number of illustrations. We believe it sells at $1 per copy.

Published by Centro de Estudos Economicos, Rio de Janeiro, Brazil.

WITH OUR DEALERS

Russell N. Edwards, Manager of the Cooperative Mineral Exchange, 79 Goffe St., New Haven, Conn., has through field collecting, exchanges and purchases, acquired a large stock of choice mineral specimens. He is one of our newest dealers, and our best wishes are extended him.

John A. Grenzig, the veteran dealer of 299 Adams St., Brooklyn, N. Y., has placed his private mineral collection on the market. Here is a chance for some one to purchase an exceptionally fine collection—over 1,200 specimens—that had been assembled during the past 60 years.

John Albanese, P. O. Box 281 (formerly 502 S. 15th Street), Newark, N. J., is specializing in Franklin, N. J., minerals. He has purchased a number of collections of these minerals and thus has an unusually large stock.

Collectors' Tales

By PETER ZODAC

Beginner's Luck

About 30 or 40 years ago when I was foreman of the old Gillette pegmatite quarry at Haddam Neck, Conn., my brother-in-law, Thomas H. Thropp, who was president of the company, one day brought a friend, a Mr. B., to visit us. After dinner, the visitor, an old Englishman who had made a nice fortune in the hotel business, wanted to know where we found those "termalins," he had heard so much about. (Gillette quarry was famous for its fine tourmalines).

"George," said my brother-in-law." show him."

We had blasted that afternoon and as usual had examined the walls of the quarry for pockets in which would be the tourmalines. (Our lease stated that all gem crystals as tourmaline and beryl belonged to the owner of the property, Mr. Gillette, we retaining the feldspar, mica, and quartz). The pockets that afternoon yielded some tourmaline but nothing to crow about.

The above-mentioned gentleman was taken to the quarry and allowed to examined the pockets of which there were two. After a thorough search in which he found nothing of value, I took him into the main working and explaining what we were quarrying and showing him specimens of feldspar, mica, and quarry, left him alone feeling certain he would again find nothing of value.

Soon a shout was heard.

"Hey, Georgie, what's this?"

I rushed back to him and was amazed to see in his hand a wonderful crystal of green, gem tourmaline.

The sequel to this is that my brother-in-law thanked me for planting the crystal. Was my face red! He actually thought I did it.

About a year later I had occasion to visit Trenton, N. J., where close to the Clinton St. depot was the hotel which Mr. B. owned. I went in and there was Mr. B. behind the desk. He was very glad to see me. The first thing I spotted was a beautiful green tourmaline in his necktie pin. Out of curiosity I asked him what he would take for it.

"Georgie," said he, "I wouldn't take $1,000 for it. I dug it out of the rock in your quarry with my bloody 'ands."

There *is* a moral to this.

George Wilkes

COLLECTOR'S KINKS

Preserving Marcasite Against Deterioration

Some marcasites deteriorate easily. To protect such specimens give them a coating of balsam and xylol.

I use 1 part balsam to 7 parts xylol which I get mixed at a drug store and thus it is ready for use. One pint will last a long time.

I dip a marcasite in to this mixture—suspending the specimen by a string—then hang it up to dry. This may take 2 or 3 days. Place a dish under each specimen to catch the drip. Furthermore, I give each specimen 2 or 3 coats; thus it may take a week or more to finish coating one specimen.

Arthur H. Jones.

A MANSIZE LAPIDARY MACHINE THAT WORKS

By F. C. KESSLER

Canon City, Colorado

"Didn't cost anything," said Dave Cowan one morning during a snow storm, when asked about a stone cutting device he was demonstrating to a half dozen shivering quarrymen. "Joe and I made it out of scraps and gadgets we found around the shop during spare time. All we intend to do with it is cut samples for advertising purposes."

The machine is eight feet high, eight feet long and four feet wide, built of 6 x 6 timbers. The saw carriage is swung on four half-inch cables and propelled by a Ford motor attached to an eccentric that runs at 100 revolutions a minute. The shaft between the motor and carriage is twelve feet long, made of 3 x 6 bridge timber. When the men questioned Dave about the massivesness of the machine, he said, "We have the power. Why not use it? The engine will pull this gang-saw with fourteen blades as readily as it will a single blade and we'll get fourteen samples instead of one." The gang saw itself looks more like a cattle guard at a railroad crossing than anything else. It is made of fourteen steel plates one-eight of an inch thick, 3½ inches wide and eight feet long. The plates are set by means of bolts at the ends for convenient adjustment. A huge block of marble 30 inches square and 22 inches thick was in the machine with all fourteen saws working. This made the cutting rate rather slow, about an inch to the hour. For an abrasive, quartz sand is used. Dave explained how quartz sand is obtained in such large quantities by kicking his foot against a sturdy little giantlike contrivance, hooked onto an electric motor and saying, "We make it here in this crusher. We made the crusher, too."

The huge block of marble was taken from the Cowan Brothers' ranch northwest of Canon City, where a number of thick bodies of marble occur. Deep ravines and narrow canons run through the property. Timber is scarce. In color and design the marble is of unusual beauty, running from lavender to a light maroon, veined with brown and clouded in spots to a warm yellow—much like the high priced Siena marble of Italy. Analysis from reliable sources show that the hardness and durability rank among the highest on record and that its polishing qualities are unexcelled. The beds occur in benches from one to several feet thick with joints far enough apart to make large blocks available. In some places good building stone can be quarried without the use of explosives. The few fossil finds made so far in the formation are of marine life suggesting that a poor grade of limestone was laid down in early seas. It was later distrubed by earth movements, cracked and crumpled and probably exposed to the weather for several geological periods, because erosion is evident. Later consolidation of these

A block of marble under the gang saw

crumpled beds took place by the process of cementation. Replacement of the lime content with iron and silica metamorphosed the drab limestone into the present marble with its unique pattern and unmatched coloration. This deposit outcrops for a distance of more than two miles along the mountain side and is easily accedible from U. S. Highway 50.

On another section of their 800 acre ranch, the Cowan Brothers have opened a travertine quarry that is producing building material of equal quality to that of the first quarry. The travertine takes a beautiful light buff finish in a hard crystalline texture that is highly weather resisting. Seldom is travertine found in sufficient quantity to warrant operation of a quarry for building stone, but Fremont County has provided veneer for the Telephone Building at Fourteenth and Arapaho Streets in Denver, as well as for the Ideal Building at Seventeenth and Champa Streets in Denver. At the present time the Colonia company is running day and night to fill an order in San Francisco, more than a thousand miles away. This long shipment in spite of the high freight rates in the Rocky Mountain states may tend to verify the assumption that travertine as a building stone is rare.

Between the two quarries on the Cowan ranch is a thrust fault in the Ordovician limestone more than a half-mile long. On the north side of the fault is the quarry producing the brecciated marble while on the south side is the travertine deposit. The faulting must have taken place before Cretaceous time, because a short distance to the east is the unbroken skyline of the Dakota and Niobrara formations.

Dave and Joe did not quit when they completed their gigantic gang saw. They have built a stone polishing machine that operates with the same motor merely by shifting the belt to another wheel. It will polish a block of marble a yard square at a single adjustment.

The Cowan Brothers know their gems as well as their marbles, however they cut the gems on their home-made, but well-made, diamond saw. Ask them what is new under the sun and unhesitatingly they will brush the dust from a newly cut ring-set or two and say with a smile, "If you can't get a polish like that on a Badger Creek moss agate, come and see us sometime and we will give you the formula."

Industrial Specialists May Still Apply For Government Jobs

The Government continues its search for specialists in all branches of industry and business. The Federal Civil Service examination for Industrial Specialist, announced on July 7, has been amended to remain open for receipt of applications until further notice.

The National Defense Program needs men with experience in one or more of the following fields:

Iron and steel
Non-ferrous metals
Machine tools
Ordnance
Aircraft, marine and automotive equipment
Railroad repair shops
Radio and other electrical equipment, supplies and apparatus
Textiles
Forest products
Paper
Printing and publishing
Chemicals and allied products
Plastics
Petroleum and coal products
Rubber products
Stone, clay and glass products
Leather and its manufactures
Food and kindred products

Salaries range from $2,600 to $5,600 in the various grades. No written examination is given. Application forms may be obtained from Civil Service Representatives at any first- or second-class post office or at a Civil Service District Office.

Clubs Affiliated With the Rocks and Minerals Association

ARIZONA

Mineralogical Society of Arizona
Geo. G. McKhann, Sec., 909 E. Willetta Street, Phoenix.
Meets at the Arizona Museum in Phoenix on the 1st and 3rd Thursday of each month.

CALIFORNIA

East Bay Mineral Society
Miss Marjory Welch, Sec., 3268 Central Avenue, Alameda.
Meets on the 1st and 3rd Thursdays of each month (except July and August), at 8:00 p.m., in the Lincoln School Auditorium, 11th and Jackson Sts., Oakland.

Northern California Mineral Society
A. L. Rogers, Sec., 137½ Joost Ave., San Francisco.
Meets on the 3rd Wednesday of the month at the Public Library in San Francisco.

Southwest Mineralogists
Mrs. Pearle Arnold, Cor. Sec., 2132 W. 76th St., Los Angeles.
Meets every Friday at 8:00 p.m. at Manchester Playground, 88th and Hoover Sts., Los Angeles.

COLORADO

Canon City Geology Club
F. C. Kessler, Sec., 1020 Macon Ave., Canon City.
Meets on the 1st and 2nd Saturdays of each month at 9:00 a.m. in the High School Building Canon City.

Colorado Springs Mineralogical Society
Lynn M. Hopple, Sec.-Treas., Motor Route 2, Colorado Springs.
Meets usually at the Lennox House, Colorado College Campus, Colorado Springs, on the 2nd Monday, of each month at 7:30 p.m.

CONNECTICUT

Bridgeport Mineral Club
Mrs. Julia Walker, Sec., 55 Eaton Street, Bridgeport.
Meets in the Bridgeport Public Library on the 3rd Monday of the month.

Long Hill Mineral Club
Eugene F. Robinson, Secc., R. F. D. No. 4, Box 237, Bridgeport.
Meets on the 4th Tuesday of each month at 8:00 p.m., in the Hawley Memorial Library, Long Hill.

Mineralogical Club of Hartford
Mrs. L. T. Goodrich, Sec., 51 Jerome Avenue, Bloomfield.
Meets the 2nd Wednesdays of each month, at 8:00 p.m., at 249 High St., Hartford.

New Haven Mineral Club
Mrs. Lillian M. Otersen, Sec., 16 Grove Place, West Haven.
Meets on the 2nd Monday of the month at the Y. W. C. A. on Howe St., New Haven.

IDAHO—OREGON

Snake River Gem Club
Margaret L. Hearn, Sec., Payette, Idaho.
Meets alternately in Payette and Ontario, Oregon, (two small cities on the Snake River) on the 3rd Tuesday of every month.

ILLINOIS

Junior Mineral League
E. Johansen, Sec., Morgan Park Junior College, 2153 W. 11th St., Chicago.

MAINE

Maine Mineralogical and Geological Society
Miss Jessie L. Beach, Sec., 6 Allen Avenue, Portland.
Meets last Friday of the month at 8 p.m., at the Northeastern Business College, 97 Danforth Street, Portland.

MARYLAND

Natural History Society of Maryland
2103 N. Bolton Street, Baltimore.
Office hours, Tuesdays and Fridays, 10:00 a.m. to 5:00 p.m.

MASSACHUSETTS

Connecticut Valley Mineral Club
Leo D. Otis, Sec., 12 Clark St., Westfield, Mass.
Meets on the 1st Tuesday of each month at 8 p. m. at various institutions in the Connecticut Valley.

MISSOURI

National Geologist Club
Mrs. D. P. Stockwell, Pres., Mt. Olympus, Kimmswick.

NEVADA

Reno Rocks and Minerals Study Club
Mrs. Rader L. Thompson, Sec., Box 349, R2, Reno.
Meets on the 1st Wednesday of each month, at 7:30 p.m., at the Mackay School of Mines, Reno.

Western Nevada Mineral Society
A. Cornely, Sec.-Treas., P. O. Box 21764, Reno.

NEW JERSEY

Newark Mineralogical Society
William E. Simpson, Sec. 308 Grove Street, Montclair.
Meets on the 2nd Sunday of the month at 3 p.m. at Junior Hall, corner Orange and North 6th Streets, Newark.

Plainfield Mineralogical Socicty
Joseph D'Agostino, Sec.-Treas., 711 Sheridan Avenue, Plainfield.
Meets on the 1st Tuesday of the month at 8 p.m. at the Plainfield Public Library.

NEW MEXICO

New Mexico Mineral Society
R. M. Burnet, Sec.-Treas., Carlsbad.

Society of Archaeology, History and Art
Carlsbad.

NEW YORK

Chislers, The
Miss Evelyn Waite, Sponsor, 242 Scarsdale Road, Crestwood, Tuckahoe.
Meets bi-monthly at members' homes.

Queens Mineral Society
Mrs. Edward J. Marcin, Sec., 46-30—190th Street, Flushing.
Meets on the 2nd Thursday of the month at 8 p.m. at 289 Etna Street, Brooklyn.

OKLAHOMA

Oklahoma Society of Earth Sciences
W. P. Smiley, Sec.-Treas., 229 W. Jefferson Street, Mangum.
Meets on the 2nd Tuesday of each month, at 7:30 p.m., at the Historical Museum, Mangum.

PENNSYLVANIA

Thomas Rock and Mineral Club
Mrs. W. Hersey Thomas, Pres., 145 East Gorgas Lane, Mt. Airy, Philadelphia.
Meets on the 3rd Friday of each month, at 8:00 p.m., at the home of its president, Mrs. Thomas.

VERMONT

Mineralogical Society of Springfield
Victor T. Johnson, Sec., 11 Elm Terrace, Springfield.
Meets on the 3rd Wednesday of each month at 8:00 p.m. at the homes of members.

WASHINGTON

Gem Collectors Club
Mrs. Llyod L. Roberson, Sec., 522 North 70th Street, Seattle.
Meets on the 1st and 3rd Tuesday of each month (except during the summer) at 8:00 p.m., at the Y. M. C. A.

Washington Agate and Mineral Society
Monroe Burnett, Sec., 802 S. Central St., Olympia.
Meets on the 1st Monday of the month, at 7:30 p.m. at the home of some member.

COLOR Illustrations in LIFE

July 21, 1941 issue

Mineral collectors were pleasantly surprised to see two full pages in color devoted groups from this original discovery. Sizes from 1" to 4" at 75c, $1.00, $1.50,

We are pleased to advertise for the first time, gorgeous RED WULFENITES, Red Cloud Mine, Arizona, from Edwin Over's find of two seasons ago. This, without doubt, was the most beautiful lot of brightly colored wulfenites ever found! A few matrix specimens are still available at $1.00, $2.00, $3.00, $5.00 and $7.50. Bright red single xls at 50c, $1.00, $2.00 and $3.00. Excellent single crystals of exceptional color and quality at $5.00, $7.50, $10.00 and $15.00 each.

Once again we offer choice YELLOW WULFENITES, Hilltop, Arizona. The specimens we offer are from the original find by Edwin Over several seasons ago. Many specimens of inferior quality have been produced since but we still offer unexcelled groups from this original discovery. Sizes from 1 to 4" at 75c, $1.00, $1.50, $2.00, $3.00 and $5.00. Larger and museum sized specimens in stock.

We also have in stock a great variety of VARISCITES, Fairfield, Utah, AURICHALCITES, Bisbee, Arizona and AZURITES from Bisbee, Arizona and Tsumeb, South West Africa.

ALL OF THE ABOVE ARE ILLUSTRATED IN COLOR IN LIFE!!

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BOOKS

Handbook For the Amateur Lapidary by J. H. Howard, 16 chapters covering all phases of gem cutting and polishing, 141 pp., 14 illus., price $2.00. J. H. Howard, 504 Crescent Ave., Dept. R., Greenville, S. C.

How to Collect Minerals. By Peter Zodac. A guide book for the collector. 80 pp., 15 ills., $1.00. Rocks and Minerals, Peekskill, N. Y.

Fifty Back Numbers of Rocks and Minerals Magazine, all in good condition and all different, $10.00. If you have back numbers send a list of them with your order and we will try not to duplicate any of them. Rocks and Minerals, Peekskill, N. Y.

History and Geology of the Royal Gorge, an illustrated souvenir booklet with maps and drawings locating 54 minerals for touring collectors. 50c postpaid. F. C. Kessler, Canon City, Colo.

FOSSILS

Fossils, Minerals, Old Arms, Indian Beaded Trappings, prehistoric specimens, general line of curios. Lists 10 cents. N. E. Carter, Elkhorn, Wisc

EXCHANGES

I WANT TO EXCHANGE MINERALS. CAN OFfer fayalite, forsterite, thorite, triphylite, heterosite, manganapatite for good specimens from other localities. Gunnar Bjareby, 147 Worthington St., Boston, Mass.

Wanted: In exchange for fine mineral specimens from our lists, Aquamarine, Bertrandite, Beryllonite, Cachentaite, Chanarcillite, Chilenite, Chrysoberyl, Danalite, Emerald, Euclase, Eudidymite, Gadolinite, Hiddenite, Huntelite, Phenacite. Co-op Minerals, 79 Goffee Street, New Haven, Conn.

MINERALS

Millerite from Milwaukee, Wisconsin. Benedict P. Bagrowski, 1014 Vt., Lawrence, Kansas.

Beautiful Opals-Direct from Australia. Lapidaries Parcel, 10 ounces cutting opal, (about 50 stones) $10.00. Collectors specimens—good attractive parcels. 5.00, 10.00 Dozen small black opals $5.00. 10 ounces small opal chips $5.00. Illustrated catalogue No. 47 free. Natural History Books (thousands), lists free. Norman Seward, "Opal House," Melbourne, Australia.

MINERALS

Minerals, Fossils, Indian Relics, Books, Coins, Curios, Stamps. Old Glass. Catalogue 5c. Indian Museum, Osborne, Kansas.

Scott Rose Quartz Co.—Rose Quartz, Black Hills specimens, all kinds and colors; for rock gardens, cabinets, etc. Boxes: 24 specimens, $1.00; 18 specimens, 50c; 15 specimens, 35c. Postage paid. Box 516, Custer, S. Dak. Send stamp for price list.

Superb Utah Azurite Specimens, $1.00, $1.50, $2.00. New Bingham Pyrite, $1.00, $2.00, $5.00. Postage. The Berryman Menage, 412 East 9th South, Salt Lake City, Utah.

Uvarovite—Choice specimens. Minute brilliant emerald-green crystals coating ore. For details write: H. Goudey, Jamestown, Calif.

New England minerals for sale or exchange. Correspondence solicited. Rudolf C. B. Bartsch, 36 Harrison St., Brookline, Mass.

Twelve genuine opals, Mexician and Australian, $1.00. Twelve genuine amethysts, $1.00. B. Lowe, Box 525, Chicago, Ill.

Mineral Specimen Cabinets—15 to 100 specimens. Prices 35c to $10.00. Cabinet specimens—free price list. Charles O. Scott, 739 Colorado Ave., Trinidad, Colorado.

PYROMORPHITE—Green xls encrusting quartz. 10c to $1.00. Dekro Mineral Company, 7029 Lincoln Drive, Philadelphia, Pennsylvania.

Beautiful and unusual satin spar xls like stems, branches and flowers and curved ribbons. Priced from 25c to $5.00 each. Frank Duncan, Box 63, Terlingua, Texas.

Gem quality Washington carnelian, beautifully polished slabs, 15c per square inch. Unpolished 10c. Harry Fritz, 707 N. 65th St., Seattle, Wash.

Alexandrites (diamond cut) from 3 carats up $1.25 per carat. Zircons genuine diamond cut 3 for $1.75. B. Lowe, Box 525, Chicago, Ill.

FLUORESCENT MINERALS

Franklin, N. J., Minerals. Fluorescent. Phosphorescent. Rare. 25-50-75-$1.00. Send for list. Museum specimens quoted upon request. John Albanese, P. O. Box 281, Newark, N. J.

CALCITE Fluoresces Green. Rare. Limited Supply. Hurry. 3 x 4—$1.00 Postpaid. Guaranteed. Write for list of Fluorescent and Polishing Minerals. Dr. R. E. Anderson, Box 575, Deming, New Mexico.

Fluorescent calcite mixed with sphalerite and galena. I have been mining specimens for ten years and this is the only calcite I have found which will fluoresce under the black bulb or quartz light and only a small quantity available. For sale or trade for good willemite or wernerite. J. A. Robertson, Box 105, Baxter Springs, Kansas.

Colemanite, 2 x 2"—25c | **Co-op Minerals, 79 Goffe St., New Haven, Conn.**